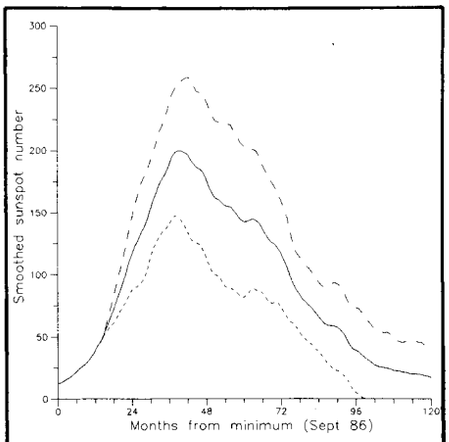

Fig. 2. Predicted profile for Cycle 22 from the method of McNish and Lincoln. Included are the lower and upper 90% confidence intervals for the predictions.

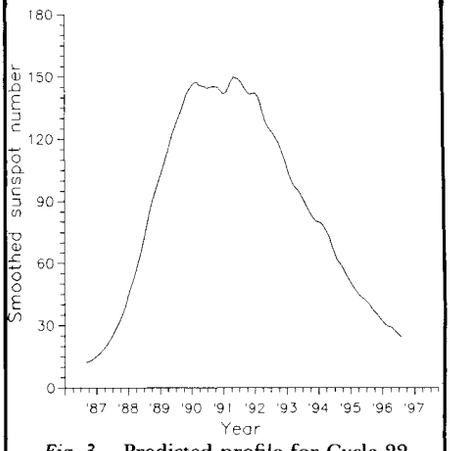

Fig. 3. Predicted profile for Cycle 22 obtained by using the average of the even sunspot cycles adjusted to a smoothed sunspot maximum of 150.

extended rate of rise become increasingly accurate.

- The probability of an average or lower cycle is quite low.
- There are several indications that Cycle 22 will have a long, flat period of maximum, especially in 10.7-cm flux.

Acknowledgments

We thank our many colleagues in both the solar-terrestrial physics community and in the practical areas of operations and technical applications that are affected by solar activity, for fruitful discussions about the cycle and the effects of the environment on practical applications.

J. W. Hirman, G. R. Heckman, M. S. Greer, and J. B. Smith are affiliated with NOAA Space Environment Laboratory, Boulder, Colo.

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Meeting Reports

CEDAR 88

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The third workshop session of the National Science Foundation's Coupling Energetics, and Dynamics of Atmospheric Regions (CEDAR) initiative took place at the National Bureau of Standards and National Center for Atmospheric Research institutions in Boulder, Colo., June 6–10, and was attended by 155 participants, including about 40 graduate students.

The CEDAR initiative represents the fruit of many years of efforts by the aeronomy community and NSF to modernize the techniques used to understand the many processes of the upper atmosphere both theoretically and experimentally. Since the beginning of this initiative (under the old name of Ground-Based Optical Aeronomy) with a summer meeting in Logan, Utah, in 1983, there has been a workshop meeting every summer. The 1988 CEDAR meeting, in particular, reflected the growing maturity of the CEDAR initiative. The meeting was well attended, and, in general, we found fewer participants drawn to the meeting just by curiosity and more who came because they expected the workshop activities would be time well spent.

The 1988 workshop meeting marked the start of a busy summer that included a total of five major meetings on the aeronomy calendar. Attendees arriving from the east on June 5 were greeted by the sight of a tornado funnel near the Denver Stapleton Airport, a prelude to much discussion of the dynamics of the upper atmosphere that ensued in the various CEDAR workshop meetings.

The morning sessions were held in the NBS auditorium, where tutorial lectures and other talks provided the participants with detailed accounts of the historical developments of disciplinary and instrumental areas of aeronomy. An excellent example of the latter was the talk presented by Chet Gardner (University of Illinois, Urbana), who discussed the development of the lidar instrument that is designed to study the density and temperature structure of the middle atmosphere and lower thermosphere. Lyle Broadfoot (University of Arizona, Tucson) gave an instrumental design review on the construction and fabrication of a grating spectrograph fitted with a

charged-coupled device (CCD) detector, and results from instrumental tests and observations from Kitt Peak should be in hand by summer 1989. A similar review on all-sky imaging was presented by Michael Mendillo and Jeff Baumguarder (both from Boston University) on the state of the art technology for their all-sky CCD imager, which was used in the August Kwajalein campaigns. These talks are designed to educate the community about the capabilities these CEDAR-funded instruments will bring to future CEDAR campaigns.

One of the major highlights of this CEDAR meeting was the excellent tutorial review of solar terrestrial relations given by George Reid (NOAA Aeronomy Laboratory, Boulder). This talk explored the development and evolution of solar terrestrial relations from the first theories of Chapman and Ferraro, through the major breakthrough represented by the work of Axford and Hines in 1961, to today's level of sophistication where the coupling of the solar wind to the magnetosphere and the coupling of the magnetosphere to the high-latitude ionosphere and auroral zone are active issues of current research. This introduction to magnetospheric physics was followed by a talk by Dick Wolf (Rice University, Houston, Tex.) on the theory of the numerical modeling being developed to study these coupling questions. His excellent review described the development of the time-dependent three-dimensional Rice magnetospheric model which is able to reproduce in reasonable detail the observations of global-scale field-aligned current systems.

Later in the week, a lecture by William Wagner (Environmental Research Laboratory, Boulder) on the technique for predictions of the timing of solar maximum for solar cycle 22 was made notable by the posting of the 10.7-cm-flux index by the Space Environment Laboratory located in the same building. Each day of the meeting this index pushed higher into new ground registering a rise from 150 on June 1 to 163 on June 9. Since then this index dropped back into the 120s level before recovering and rising to near 190—the largest since 1983. Wagner concluded his talk with the prediction that the amplitude of the solar maximum cycle expected for 1991 will be possibly as large as the 1958 solar cycle and may occur a year early. Even-numbered solar cycles have demonstrated a tendency to recover quickly from the region of solar minimum and to show a broad structure around the period of solar maximum.

The tutorial lectures were concluded with talks by Harry Van Loon (NCAR) and Brian Tinsley (NSF) on the issues relating to the possible connection between solar variability and atmospheric parameters (such as the stratospheric temperature at the 30-mbar level) when the latter are sorted according to the sign of the quasi-biennial oscillation observed in the stratospheric winds of the equatorial region. The possibility of such a connection runs somewhat counter to intuition, but the high degree of correlation demonstrated dispels skepticism and disbelief. It is clear that the CEDAR initiative ought to explore possible physical mechanisms. One of the many splinter workshops held in this meeting met to discuss possible ways that the existing data base might be used to investigate possible sun-weather mechanisms.

Stanley Shawhan presented the NASA view of the CEDAR initiative by reviewing the many space flight programs. In spite of the current hiatus in launch capability that has resulted in the best space flight program "on the ground," there are numerous satellites producing valuable data on parameters of importance to the CEDAR initiative (San Marco, ISEE, IMP-J, DE-1). While NASA cannot contribute directly to the CEDAR resources, NASA encourages the coupling and coordination of its future plans with the thrust of the CEDAR initiative in future years. An example cited for such coordination is the expansion of the scheduled Kwajalein 1990 and Arecibo 1991 CRESS sounding rocket campaigns, currently designed to study primarily the plasma effects generated by the deposition of chemical releases into the F region, to include middle atmosphere sounding rocket payloads. This effort would utilize the recent CEDAR-funded extension of Arecibo's radar capabilities into the middle atmosphere, as well as the planned upgrading of the Kwajalein Altair radar. Another issue touched upon relating to CEDAR 1990s objectives was the class of Explorer and Scout satellites. These missions are low-cost initiatives with an expected lifetime from conception to flight that should be more compatible with the average lifetime of a successful graduate student. One important mission proposed and given a design study award is designated MELTER, which emphasizes the study of the composition, dynamics, and chemistry of the lower thermosphere through remote sensing techniques.

Dennis Peacock and Richard Behnke (both of NSF) discussed the favorable response provided by the NSF to the CEDAR program. Even though fiscal year 1988 represented a year of flat funding for the Foundation as a whole, NSF mustered a total of nearly one million dollars to fund the best 12 of the 38 CEDAR proposals submitted last October. This increment of the normal aeronomy and upper atmosphere facilities budgets represents a solid indication of support and commitment by the Foundation to the CEDAR program. The fact that the Foundation could do this can be largely attributed to the strong grass root support for CEDAR and the large number of well-written and carefully thought out proposals. While the actual agency funding increase for the next fiscal year may not be the requested amount of 17%, NSF hopes to provide additional CEDAR funding for the CEDAR proposals expected this October. The incremental amount requested for these proposals in the current program plan is $1.2 million.

Peacock also discussed the reorganization of the grant program section that now includes three programs: aeronomy, magnetosphere, and solar physics. The total funding for the Upper Atmosphere Research section budget is about $14.3 million. The funding level for upper atmosphere facilities and for the High Altitude Observatory at NCAR, both part of the Center and Facilities Section, is about $8.5 million.

The talk presented on Geospace Environment Modeling by Juan Roederer indicated how well CEDAR is now perceived as a model for similar initiatives in other fields. GEM is an effort to generate a cohesive program plan that would focus along with MAX '91 upon the upcoming solar cycle maximum. Both initiatives are given high priorities with CEDAR as part of the NSF-long range program plan.

Summaries of the first report on the CEDAR data base prepared by Robert Sica, chairman of the data base committee, were presented by Barbara Emery, Art Richmond, and several other scientists representing the instrumental areas of Fabry-Perot interferometry, spectroscopy, and radar systems. Also included was a report by Cassandra Fesen on the plans for the CEDAR data base to provide an accessible repertoire of theoretical subroutines and user-friendly computer codes needed for the modeling of the Earth's composition, chemistry, particles, neutral wind, and electric fields for all CEDAR atmospheric regions. Included among these tools would be a collection of programs designed to generate synthetic spectra for optical aeronomers.

The most compelling issue addressed in this review on the CEDAR data base plan was the need for experimentalists to plan the integration of their individual data bases into a community pool for use by anyone interested in coordinating results obtained in a CEDAR campaign effort. The data base concept has viability only if it is used, and that will only happen when it becomes obvious that such efforts will be mutually beneficial to everyone. Considerable time was devoted to the discussion of the "rules of the road" representing the guidelines drawn up to formalize the data base use procedures thought necessary to cover the various possibilities. While the current state of the fledging CEDAR data base does not allow any on-line interaction with data archived in the data base, plans submitted to NSF for upgrading call for a dedicated computer equipped with high-speed data access lines that would support such access. These plans also include the incorporation of the Millstone Hill interactive software.

The afternoons of the CEDAR meeting were hectic and filled with numerous workshops. The many acronyms used to designate the individual projects were staggering and collected together represented veritably the proverbial alphabet soup. The range of topics represented in these projects included the middle atmosphere and mesospheric dynamics (AIDA), the lower thermosphere (LTCS), studies on hydrogen in the exosphere (CHARM), application of twilight airglow emissions to study thermospheric composition (TWILIGHT), the effect of auroral heating upon the lower thermosphere dynamics (ARIA), the study of mesospheric temperature and intensity structure in the observed airglow emissions (MAPSTAR), Sondrestrom optical and radar campaign observations devoted to the study of the oxygen composition in the auroral thermosphere (OXYGEN), a workshop on the exploitation of the San Marco satellite (SAN MARCO), and a workshop on the equatorial dynamical studies planned initially for Kwajalein in August 1988, and later in the 1990s (EQUATOR). Workshops were also held on the structure of the global thermosphere (GITCAD), the time-dependent behavior of the ionosphere-magnetosphere coupling at high latitudes (GISMOS), the global thermosphere mapping study (GTMS), the equinox transition period of thermospheric dynamics (ETS), the ionospheric plasma structure in the polar cap re-

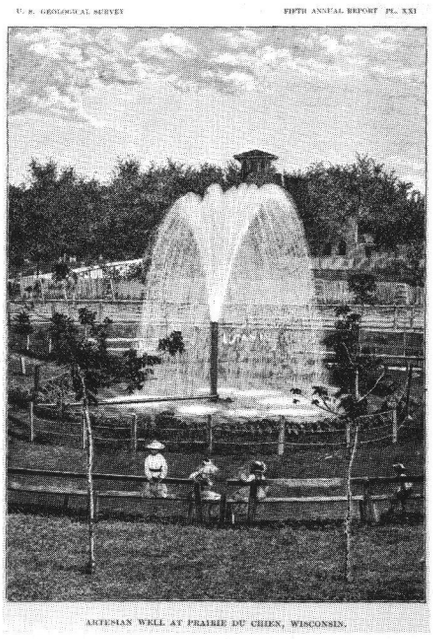
gion (HLPS), and the sun-weather connection (QBO).

At any one time, many CEDAR projects are in the throes of being born while others are in the mature phase. It is not possible to attend all of these workshops or to plan to commit one's time and resources to more than one or two such activities in a year. The natural question arises as to whether there are too many of these projects of a similar nature and whether these efforts are being particularly effectual or not. This is a philosophical question best answered by watching what happens. Certainly the level of enthusiam for aeronomy that currently exists in the field has never been higher, a clear indication that what has been happening is all to the good.

From the perspective of the students the CEDAR meeting is an eye-opener into the aeronomy field. The first-hand acquaintance they gain from the close observations of the more senior workers in the field and the observation of the planning activities in the various workshops represent an important educational experience, one that is difficult to obtain from the larger and more impersonal AGU meetings. The high quality of the 25-odd posters, which were submitted largely by students and their mentors, demonstrated the excellent caliber of the current generation of students. The subsidy of the student travel with CEDAR funds is clearly a good investment, and this policy is expected to continue indefinitely. The tutorial lectures were videotaped, and copies may be requested from Barbara Emery (NCAR).

This report was contributed by John W. Meriwether, Jr., and Timothy Killeen, Space Physics Research Laboratory, University of Michigan, Ann Arbor.

WaterWatch



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WaterWatch
News of the Hydrology Section.
Editor: A. Ivan Johnson, 7474 Upham Court, Arvada, CO 80003 (telephone 303-425-5610).

News & Announcements

Along the Waterfront

PAGE 963

Peter S. Eagleson, Massachusetts Institute of Technology, Cambridge, has been announced as recipient of the 1988 Robert E. Horton Medal for outstanding contributions to geophysical aspects of hydrology. Pete is Past-President of AGU and member of the Hydrology Section since 1955.

Lisa A. Shrevenell, has received the first George Burke Maxey Hydrology Fellowship, which carries a 1-year $10,000 award for discretionary research in hydrology. She is a Ph.D. candidate in hydrology at the University of Nevada-Reno.

AGU Section of Hydrology members who are to be new officers of the American Institute of Hydrology include President John E. Moore, U.S. Geological Survey, Reston, Va.; Senior Vice President L. Douglas James, Utah State University, Logan; Vice President for Academic Affairs John M. Sharp, Jr., University of Texas, Austin; Vice President for Institute Development Richard "Pete" H. Hawkins, University of Arizona, Tucson; and General Secretary Alexander Zaporozec, University of Wisconsin, Madison.

AGU Section of Hydrology members who took office on October 1 for the American Society of Civil Engineers' Irrigation and Drainage Division are Chairman A. Ivan Johnson, Consultant, Arvada, Colo.; Vice Chairman Kenneth G. Renard, Agriculture Research Service, Tucson, Ariz.; and Secretary-Elect Lloyd C. Fowler, Consultant, Santa Barbara, Calif.

A. Ivan Johnson (AGU Hydrology member since 1948) has been elected Vice Chairman of the Board of Trustees for the newly organized Institute for Standards Research, which is headquartered in the American Society for Testing and Materials in Philadelphia, Pa.

In Memoriam

Mahdi S. Hantush died recently at the age of 66. He was a member of the Hydrology Section since 1949.

P. O. Wolf, City University, London, England (member of AGU Hydrology since 1957), was elected President of the British Hydrological Society.

"Headwaters Hydrology" and "Indian Water Rights" Symposia

PAGE 963

The American Water Resources Association's 1989 Spring Symposia, "Headwaters Hydrology," concurrently with "Indian Water Rights and Water Resources Management," will be held in Missoula, Mont., on June 27–30, 1989.

"Headwaters Hydrology" will present a timely collection of interrelated topics representing the breadth of water resource management problems and controversies encountered in headwaters regions, including the broad subject themes of wildland hydrology, degradation and rehabilitation, and water policy and management.

The deadline for submission of abstracts is November 15, 1988. Submit three copies, not exceeding 200 words and indicate if there is a preference for either poster or technical session consideration to: Technical Chairman William W. Woessner, Department of Geology, University of Montana, Missoula, MT 59812; tel. 406-243-5698.

The "Indian Water Rights and Water Resources Management" symposium will bring together various perspectives on past experience with Indian water rights adjudications, legislation, and negotiations and will review the intellectual bases for achieving efficient and equitable settlements. The following topics are appropriate: adjudication, legislation, negotiations, and resource management.

The deadline for submission of abstracts is November 15, 1988. Submit three copies, not exceeding 200 words and indicate if there is a preference for either poster or technical session consideration to: Technical Chairman William B. Lord, Water Resources Research Center, University of Arizona, Tucson, AZ 85721; tel. 602-621-7607.

Meeting Reports

Symposium on Paleohydrogeology

PAGE 963

A full-day special session was held at the 1988 AGU Spring Annual meeting in Baltimore on "Paleohydrology: Evolution of Groundwater Flow Systems." The symposium was cosponsored by the Groundwater Committee of the Hydrology Section of AGU and by the U.S. Committee of the International Association of Hydrogeologists. The symposium focused on how and why long-term changes in groundwater flow systems can influence the modern distributions of hydraulic head, temperature, and solutes in regional aquifers.

Most groundwater investigations today are on problems associated with recent human impacts on present-day hydrogeologic conditions. For example, groundwater flow and transport models are commonly calibrated using historical data collected during a few